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k. Thallus of *Lunularia* with gemmae cups, $\times 2\frac{1}{4}$.

l, m, n, o. Stages in development of gemmae, circa $\times 50$.

p. a. Gemmae with rhizoids aa. bb. grown on both ends, circa $\times 30$.

q. b.

A new fossil Grass from Staten Island.

BY ARTHUR HOLLICK.

(PLATE 298.)

PHRAGMITES AQUEHONGENSIS n. sp.

Culms round, narrowly striate longitudinally, articulate, occasionally dotted with one or more circular scars immediately above the articulations; internodes short; rhizomes tuberous, branching, consisting of irregularly rounded, articulated parts, which are longer than broad, with knots or scars either at the joints or between them; leaves wanting.

Locality: Clifton, Staten Island, N. Y.

The first discovery of specimens representing this species was made in 1894, but these merely consisted of a few fragments of jointed stems and I referred them at the time to *Equisetum*.*

Subsequently better specimens were obtained, consisting not only of jointed stems, but also of tuberous rhizomes, and their affinity with the monocotyledons was then satisfactorily established.†

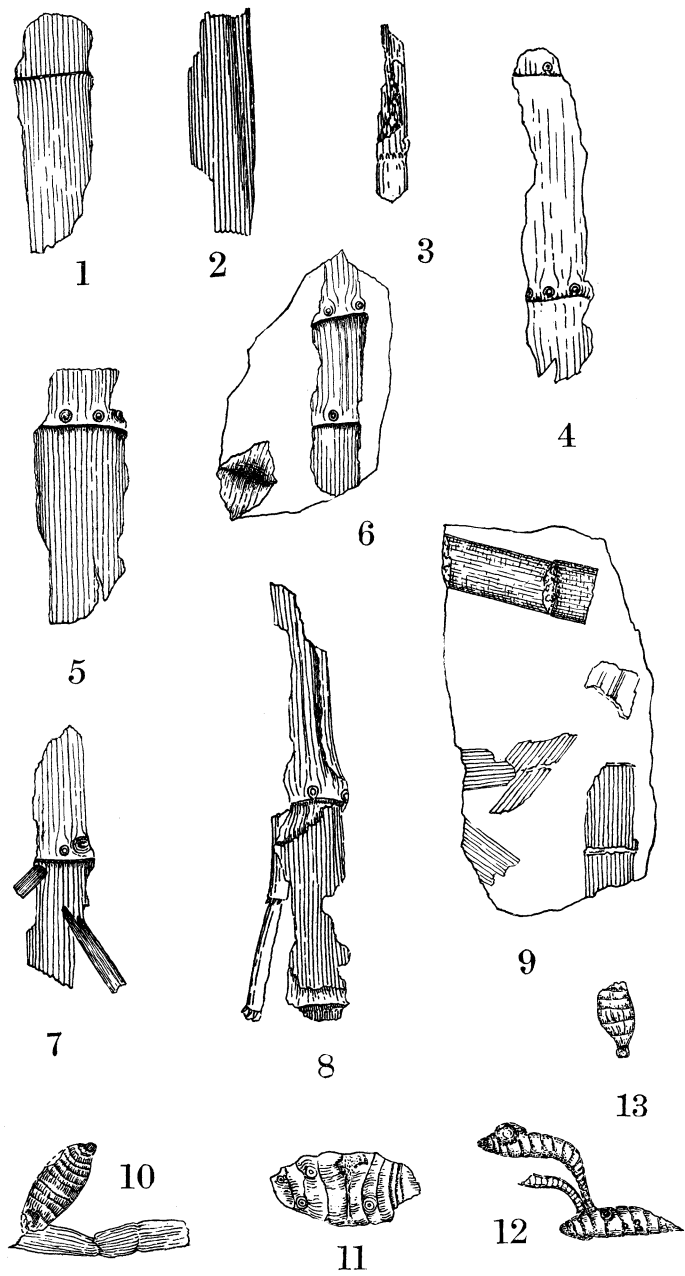
The generic name *Phragmites* has been finally adopted largely for the reason that similar fossil fragmentary remains have been described and figured under that genus, and not necessarily because our specimens are supposed to belong in it without question, although they certainly represent some grass. The specific name is coined from "Aquehonga," the Indian name for Staten Island.

The specimens figured are fairly representative of the material collected. They consist of fragments of culms and rhizomes, preserved in a conglomerate of yellow gravel, cemented with limonite.

This conglomerate is not in place where found, but forms part of the drift material, beneath the boulder till, on the extreme southern edge of the terminal moraine. It was uncovered by reason of an excavation having been made there for building sand

* Proc. Nat. Sci. Assn. Staten Isl. 4: 37.

† Ibid. 6: 12.



PHRAGMITES AQUEHONGENSIS HOLLICK.

and is associated with "kaolin" and white plastic clay, presumably of Cretaceous age; yellow gravel and sand, representing probably a recent Tertiary horizon and water-worn fragments of serpentine rock. These materials form a sort of hummock, beneath and distinct from the typical red boulder till on top and afford every evidence of having been carried forward by the advancing glacier of the Ice Age, which, upon melting, deposited on top the debris which we call the boulder till.*

The conglomerate, with its included fragments of vegetation, is, therefore, certainly pre-glacial in age. The direction of glacial movement on Staten Island was from the northwest, and as a line from the locality in question towards this point of the compass would cross the serpentine and limonite area of the Island we would naturally infer that it was from there that the conglomerate was derived. Throughout this area there are numerous deposits of limonite, associated with yellow gravel under favorable conditions, occupying basin-like depressions in the serpentine and evidently representing old swamps, around or in which a semi-aquatic vegetation flourished, prior to the advent of the Ice Age. Furthermore, as no such combination of yellow gravel, limonite and serpentine is known to occur elsewhere on the line of glacial movement, towards the locality where the conglomerate was found, we are justified in inferring that our specimens are native to Staten Island.

The problem of the exact geologic age of the yellow gravel conglomerate and, therefore, of the vegetation contained in it, has not been completely solved. Upon stratigraphic grounds Professor R. D. Salisbury decided it to belong to his Beacon Hill formation, which he classes as Miocene Tertiary in age.† It is, therefore, of interest to ascertain how the evidence afforded by fossil plants compares with this conclusion.

Grasses, as fossils are comparatively rare, and are not definitely known prior to the Tertiary period, although monocotyledons under the generic names of *Poacites*, *Bambusium*, *Culmites*, *Arundo* and

*For the geological features of the locality see description in Proc. Nat. Sci. Anss. Staten Isld. 2: 8; 3: 8; 3: 45-47, and Trans. N. Y. Acad. Sci. 11: 104; 14: 15, fig. 4.

† Ann. Rept. State Geol., N. J., 1894, 100; 1895, 3.

Phragmites, have been described from Cretaceous and even older horizons, but fossils which can be unquestionably referred to the grasses can hardly be said to date back beyond the Eocene Tertiary.*

The figures with which ours may be most closely compared are of species from either Eocene or Miocene strata in the Old World or Greenland, included under the genera *Phragmites*† and *Arundo*‡. I do not know of any having been heretofore described from the eastern United States, although broad grass-like leaves, which I am inclined to refer to *Phragmites*, occur in the yellow gravel sandstone at Bridgeton, N. J., as previously noted by me.§

The flora of the Bridgeton sandstone is almost certainly Miocene or early Pliocene in age, and we may safely refer our species to about the same horizon. It is greatly to be desired that leaves should be found in connection with the Staten Island specimens and that culms and rhizomes be found at Bridgeton. Should such discoveries be made, a more exact comparison between the two floras would be possible.

*For a general discussion of this subject see "Fossil Grasses," J. Starkie Gardner, Proc. Geologists Assn. 9: No. 6, in which copious references may be found.

†*P. Oeningensis* Al. Braun.

Heer, Fl. Tert. Helvet. 1: 64. *pl. 22, figs. 5a-e; 24; 27, fig. 2b; 29, fig. 8e.*

Ludwig, Palæontog. 8: 80. *pl. 16, figs. 1-1c; 18, figs. 2-2i; 24, fig. 7.*

Ettingsh. Fl. Bilin, 97 [21] *pl. 4, figs. 6-10.*

‡*A. (Donax) Goepperti* (Münst.) Heer, Fl. Tert. Helvet. 1: 62. *pl. 22, figs. 3a, b; 23.*

Ettingsh. Fl. Bilin, 95 [19] *pl. 4, figs. 1-4.*

Ludwig, Palæontog. 8: 80. *pl. 17.*

A. anomala (Brong.) Heer, Fl. Tert. Helvet. 1: 63. *pl. 22, fig. 4.*

§Bull. Torrey Bot. Club, 19: 330-333.